

19  
OBSERVATIONS

ON THE

ANATOMY OF THE LACTEAL SYSTEM OF  
VESSELS IN THE SEAL,

(*Phoca Vitulina*, LIN.)

AND

IN SOME OF THE CETACEOUS MAMMALIA.

(Communicated in a Letter to DR DUNCAN, Jun.)

---

BY DR. KNOX, F.R.S.E.

MEMBER OF THE WERNERIAN AND MEDICO-CHIRURGICAL SOCIETIES OF EDINBURGH.

MY DEAR SIR,

AGREEABLY to your wishes, I herewith send you a brief account of my dissection of the lacteal system in the seal, and have prefixed to it a short history of the circumstances which led to the inquiry. Many, perhaps, may be inclined to think, that the error which those great anatomists, Tiedemann and Fohmann, have fallen into, relative to the anatomical distribution of the lacteal vessels, and consequently the formation of the thoracic duct, might have been foreseen *a priori*; but the authority of these anatomists, and more particularly of Tiedemann, is such, that many naturalists and physiologists would have de-

manded a direct demonstration, and the question might thus have remained for some time problematical. The preparation I had the honour to show you lately, seems to me to decide the question for ever, and to leave no doubt whatever as to the incorrectness of the opinion of Tiedemann.

As I received from you, who are so well acquainted with German literature, the first hint on the subject, and indeed, as the inquiry was suggested by yourself, I beg of you to accept of the following observations,—and to believe me always,

My dear Sir, your's very truly, R. KNOX.

To Dr Duncan, Jun. &c. &c. &c.

# 1.

PREVIOUS to certain dissections by Professor Tiedemann and Dr Fohmann, no one had doubted that the absorbent vessels conveying the chyle from the small intestines, and generally called *lacteals*, proceeded, in the seal as in other animals, to the mesenteric glands, into which they penetrated, and in which they terminated; from which glands certain other vessels, in structure quite analagous to those just described, arose, which vessels terminated in one or other of the branches of the thoracic duct, contributing very materially towards the formation of the duct, and of the *receptaculum*, or *cisterna chyli*, placed usually at the commencement of the duct, and just where it passes through the diaphragm. The first set of vessels, those conveying the chylous fluid from the intestines to the mesenteric glands, anatomists have agreed to call *vasa afferentia*; whilst the second series, or those carrying the chylous fluid (whether the same or altered) from the glands into the thoracic duct, have generally been called *vasa efferentia*. The existence of these latter vessels in the seal has been denied by Tiedemann, who states, that the chyle, poured into the glands by the *vasa afferentia*, is absorbed by veins only, arising from these glands, and thus conveyed directly into the blood, without passing along the thoracic duct. It would follow, were this account of the anatomy of these vessels correct, that the thoracic duct in these animals was intended for carrying the lymphatic fluid only, and that the chyle passed into the general circulation by quite another route;—but nothing can be imagined more incorrect than such a statement. In the specimen of the common seal (*Phoca Vitul. Linn.*, Seehund of the Germans), which is now lying before me, and from which this description is taken, I find the lacteal vessels proceeding from the small intestines to be very numerous, distinct, and injected with

chyle; \* the greater number of them proceed towards a large mesenteric gland, about four inches in length, placed close to the spine, immediately behind the turn at the duodenum, and not far from the pancreas; the remainder of the lacteals pass into two smaller mesenteric glands, situated close to the former, but somewhat lower down. Into these glands the lacteals penetrate, dividing very generally into several branches before dipping into the gland. Near to the lower or smaller end of the largest mesenteric gland, are seen several branches of lacteal vessels (in the present specimen also loaded with chyle), arising from the gland, and speedily uniting into a larger trunk. This, in its course upwards towards the larger or diaphragmatic end of the gland, is speedily joined by many others from every portion of the gland; these united, form a large trunk, lodged in a fissure which divides the gland as it were into two, longitudinally. By the time the duct has reached the larger extremity of the gland, it is of very considerable magnitude, exceeding considerably a crow's quill, and possessing a valvular structure. After quitting the gland, it crosses over towards the right side, and mainly contributes to form the *receptaculum chyli*, constituting indeed one of its largest branches.†

The *receptaculum chyli* in the seal is very large; it is situated close to the aortic passage of the diaphragm, and may be said to be formed chiefly by two large branches. One of these, the lacteal branch, (the real *vas efferens* of the mesenteric glands), has been already described; the other is situated more towards the right side, proceeding from the loins and lower extremities. I traced it readily to the pelvis. Several other branches, but somewhat less in calibre, join the *receptaculum* from the side of the stomach and chest. The thoracic duct is large and regular; it joins the general venous circulation as usual, by entering the veins near the junction of the jugular and subclavian of the left side. The fluid contained in the thoracic duct was much thinner and less opaque than the chyle, which filled as well the *vasa afferentia* as the *vasa efferentia*.

The dissection was one of the easiest I have ever attempted; nor can I account for the extraordinary oversight of Professor

---

\* The animal was killed only two days ago.

† On laying open this large and important *vas efferens*, which was done throughout a considerable extent, it was observed, that the vessels joining it from the mesenteric glands had their orifices uniformly leading in one direction, *i. e.* in the course of the chyle, and towards the *receptaculum chyli*, in which direction only the fluid could pass, by reason of the numerous valves of the *vas efferens* and thoracic duct.



Tiedemann in any other way than by supposing his specimens to have been greatly mutilated, and totally unfit for dissection. The parts have been prepared for demonstration, though, from the great facility with which the true anatomy was made out, I scarcely deem them of that importance which otherwise would have belonged to them, had they, instead of merely correcting an error, established any new fact in anatomical and physiological science.

19th March, 1824,

## 2.

IN a letter which I had the honour to submit to you on the anatomy of the chyloferous system of vessels in the seal, (*Phoca Vitulina*, Linn.), I endeavoured to show, that whatever support the modern doctrine of "absorption by means of veins" might have derived from the supposed discoveries of Professor Tiedemann and others relative to the distribution of the lacteal system in the seal, such support must, for the future, be denied these doctrines, for the reason, that a dissection, performed as you have seen, before numerous competent judges of such matters, and under the most favourable circumstances, entirely disproved the discoveries of the distinguished German anatomist, and set the question, as I think was likewise your opinion, at rest for ever.

Permit me briefly to mention to you certain details which ought perhaps to have been introduced into my former letter, but which the comparative facility of the dissection, with such as, in the course of my comparative anatomy studies, I have been accustomed to perform, induced me to withhold.

The seal I examined had been very recently taken in a net by the fishermen in the immediate neighbourhood, so that it came into my hands in the freshest condition. The lacteal vessels of the animal, as far as the mesenteric glands, that is, the vessels usually called *vasa afferentia*, were filled with the chyle, the fluid naturally belonging to them. The great *vas efferens*, into which poured numerous smaller ones, congregating as it were from every portion of the gland, was also filled with chyle; it entered, by a very large trunk, the *receptaculum chyli*, which in the specimen I examined was comparatively large; nor had the chyle in the least altered its sensible qualities till after it became mixed with the thinner lymph, brought into the *receptaculum*, by several other great branches of lymphatic vessels which entered it, coming from the posterior extremities, loins, back, &c., and which have been already described.

Hitherto it might be said, that the knife had scarcely been used, and in this perfect and natural state, the dissection was shown to you. Previous to putting up the parts in spirits as an anatomical specimen, I filled the lacteals proceeding from the intestine (which, for brevity's sake, I shall hereafter call the *vasa afferentia*) with quicksilver; the metal penetrated the largest of the mesenteric glands, and seemed to reappear in the *vas efferens* in its way to join the thoracic duct, but this I afterwards found not to be the case. I beg of you to remark here, that there were filled with quicksilver in the seal about twenty lacteals, *and lacteals only*, for I injected those vessels alone which contained chyle. I recommend this caution strongly to the attention of those engaged in such inquiries. It has appeared to me, that after a time the lacteals empty themselves of their natural fluids, and in this state the minute branches of the mesenteric veins bear a considerable resemblance to them. It was not thought prudent to push these injections too far, lest the vessels should rupture, and the preparation (which is to be placed in the Anatomical Museum of the Royal College of Surgeons) be destroyed. Finally, previous to placing the preparation in spirits, the *vas efferens* was opened, and, on gently blowing air into it, the thoracic duct was immediately filled as high as its passage into the veins.

I conclude then, that, if ever quicksilver found its way into the mesenteric veins of the seal, on being simply injected into the lacteals proceeding from the intestine to the mesenteric glands, that such an appearance by no means marks the usual route of the chyle into the general circulation; for we have shown, 1st, that there exists at least one large *vas efferens*, of a calibre amply sufficient to convey the whole of the chyle into the thoracic duct; 2d, that this vessel, into which are poured innumerable smaller branches from every part of the mesenteric glands, is, in the healthy and fresh specimen, filled with a fluid resembling chyle in all respects; 3d, that although quicksilver did not, at least satisfactorily, pass into this vessel by being injected into the *vasa afferentia*, we have no reason to think that it may not do so in the very next specimen examined. Moreover, the *vas efferens* was filled with its own fluid the chyle, which I imagine to be much more satisfactory than if filled with quicksilver; and finally, as we shall see in the next letter, how trifling a pressure will stop the progress of quicksilver through any vessel, no important inference can be drawn from its appearance or non-appearance in the thoracic duct, unless supported by more direct testimony, drawn from the true anatomy of the part. I might add, that I have great doubts whether the

*vasa efferentia* in man can be injected by pouring quicksilver into the *vasa efferentia*. Who would venture to call their existence into question? Yet we have no other proofs of their presence than what I have offered in the seal, viz. their demonstration by dissection; their direct continuity with the thoracic duct; the origin of their roots in the mesenteric glands; lastly, *their injection with chyle.* \*

But there is a class of animals in which the phenomena attending the passage of the chyle into the mass of blood, differ in several respects from what occurs in man and in other mammiferous animals; and it has been suggested to me, that perhaps Professor Tiedemann's views might have been directed chiefly to the class of animals I now speak of, viz. the cetaceous mammalia.

As early as 1795, my much respected preceptor, Mr John Abernethy, demonstrated, that in the whale (the specimen was a male of the *genus balæna*) there are two ways by which the chyle can pass from the intestines into the thoracic duct; "one of these is through those lacteals which pour the absorbent chyle into bags (mesenteric glands), in which it receives an addition of animal fluids. The other passage for the chyle is through those lacteals which form a plexus on the inside of the bags; through these vessels it passes with some difficulty, on account of their communications with each other; and it is conveyed by them to the thoracic duct, in the same state that it was when first imbibed from the intestines." †

The peculiarities in the anatomy of the lactiferous vessels of the whale, as discovered and first described by Mr Abernethy, are important. There are *vasa efferentia* which are continuous with the *vasa efferentia*, and with the thoracic duct. ‡ But as the lacteals open into the interior of the mesenteric glands (which are in this animal hollow internally) by sufficiently wide orifices, and pour the chyle into a central cavity, into which also enter numerous veins and arteries, also by large

\* I do not expect that physiologists shall set aside the usual arguments in favour of venous absorption; but the presence of a *vas efferens* in the seal, and its great size, and, moreover, the facility with which it may be seen, render the opinion extremely improbable, not to use a stronger expression, that the chyle enters the mass of blood by any other route than that of the thoracic duct,

† Phil. Trans.

‡ I suppose them continuous with the thoracic duct; but it is to be remarked that they were not traced to that vessel by Mr Abernethy. Neither is it stated, in the Memoir alluded to, whether or not any lacteals were observed to arise from the cavities contained in the mesenteric glands, and proceed to join the thoracic duct; these are important points in the discussion, and merit a farther minute examination. It is to be remembered, that the specimen examined by Mr A. had been detached from the animal.



and distinct orifices; it must be evident, that when quicksilver is poured in sufficient quantity into these cavities through the *vasa efferentia*, it will more readily find its way into the general venous system than into the thoracic duct, by reason of the smaller size of the respective vessels. But though this happens to quicksilver in the dead body, every physiologist knows, that a precisely inverse law may take place in the living; and it is sufficiently remarkable, that in the Memoir of Mr Abernethy on the Anatomy of the Whale, that eminent physiologist, though he found numerous orifices of veins entering into the central cavities of the mesenteric glands in that class of animals, does not therefore infer that the chyle passes into these veins; on the contrary, he infers that there are *vasa efferentia* which absorb the chyle so poured out; but it is matter of regret, that the existence of such vessels was not proved by him.

I became very anxious to ascertain if such an anatomy of the mesenteric glands and lacteals as had been discovered by Mr Abernethy, existed also in the common dolphin or porpoise; for I had been assured by a friend, that he had seen a specimen in which the quicksilver, injected into the *vasa inferentia*, passed readily into the mesenteric veins, and so into the general circulation. In the first specimen I examined, I observed that quicksilver did pass from the mesenteric glands into the *vena portæ*, by means of a small vein, though not in any great quantity. But this did not happen until the animal had lain nearly three days on the dissecting table, in very sultry weather, and until I had injected rather more than sixty lacteals. By this time the chyle had disappeared from numerous vessels, and in many instances they were not easily detected. In the second specimen of this animal, dissected lately by me, though more than eighty large lacteals proceeding from the intestines, to the mesenteric gland, were filled with quicksilver, not a globule could be detected, either in the veins or in any vessel or *vas efferens*, which could be traced to the thoracic duct.\* The reason of this I imagine to be, that the radicles of the *vasa efferentia* are very small, and that these vessels do not collect into one or two large branches, in the manner of most other animals, but proceed directly to the next plexus of absorbents, which in the dolphin supply the place of the *receptaculum chyli*. With all my efforts, and after the most careful dissection, I could only trace distinctly two other *vasa efferentia*, proceeding

---

\* It is to be remarked here, that only those vessels were filled with quicksilver which evidently contained chyle.

directly from one of the mesenteric glands, into a branch continuous with the thoracic ducts. Moreover it is to be observed, that the mesenteric glands in the porpoise are remarkably firm. I cut open several of them, and found the injected quicksilver uniformly contained in their proper vessels, whose very thin tunics formed a striking contrast with the surrounding firm substance, of which the gland is chiefly composed.

Without meaning to deny that there are certain grounds for supposing, that in certain animals, the chyle may follow a different route in its way to the general circulation, I may, in the mean time affirm, that we cannot infer, from the passage of quicksilver into the veins of dead animals, after traversing the *vasa inferentia* and mesenteric glands, that the chyle in living vessels adopts the same route to reach the general mass of the blood.\*

### 3.

IN my last letter to you, I briefly recounted the circumstances which led me to inquire into the anatomical distribution of the lacteals in cetaceous animals; and I detailed the results (somewhat unsatisfactory) of two extremely laborious dissections. In neither of these had I seen the *vasa efferentia chylifera*; and being at the same time aware, that their existence, so far as I know, had been merely presumed by preceding anatomists, but had not been distinctly demonstrated, I felt disposed to think that there might be something in the anatomy of these animals, not very well understood. Some of the arguments for and against the doctrine of absorption of the chyle by veins I have stated in the letter immediately preceding this.

The result of the inquiry into the lacteals of the porpoise being thus by no means satisfactory to me, I availed myself of the first opportunity of again resuming it, and of conducting the dissection, and injection of the lacteals, somewhat differently. Having therefore obtained a third specimen of the porpoise, † my first care was to inject with quicksilver a considerable number of the lacteals high on the mesentery, and nearest to the commencement of the thoracic duct; the whole mass of the

---

\* Mr Abernethy remarks, in his admirable Memoir already so often quoted, that “the ready communication of these bags (the mesenteric glands) with the veins of the whale, induced me to examine whether I could ascertain any thing similar in other animals. Air impelled into the lymphatic glands, however, seldom gets into the veins; sometimes indeed veins are injected from their glands, but when this has occurred to me, I have observed an absorbent arising from the gland, and terminating in the adjacent vein.”

† The animal was about five feet in length, and proved to be a pregnant female.



intestines was laid over to the left side, and that no impediment might be offered to the course of the quicksilver, a circumstance I neglected in my former dissections, I carefully dissected off the portion of the lower cava and aorta, which lay immediately over the commencing roots of the thoracic duct. At this stage of the dissection, I observed numerous vessels filled with chyle proceeding from the direction of the mesenteric glands towards the thoracic duct, and terminating in it; I felt convinced that these vessels were the true *vasa efferentia*, but unwilling to rest a fact of so much importance on the bare inspection of vessels, at all times deceptive in their appearance, I proceeded to fill about a dozen of the lacteals (the *afferentia*) with quicksilver, and shortly was much pleased to observe that the quicksilver, after traversing the glands, flowed along the *vasa efferentia*, mixed with the chyle, and passed directly into the thoracic duct. The number of the *vasa efferentia* so filled, might be about six, and the quantity of quicksilver conveyed by them into the thoracic duct was such as to endanger its rupture. I next distended the thoracic duct with air, and traced it to its entrance into the veins; the valves of this vessel were as numerous as I have ever seen them, and the tunics of the duct were stronger than I expected them to be.

I ought further to mention, that the column of quicksilver used was not more than nine or ten inches in depth; yet such was the facility with which the metal traversed the glands, and penetrated to the thoracic duct, that in order to secure the preparation, and retain the fluid metal in the *vasa efferentia*, I was obliged to place a tight ligature immediately outside these glands; previous to doing this, the vessels (the *vasa efferentia*) had been twice filled with quicksilver, which had as often disappeared. So many of the *efferentia* (which are very numerous) had been cut, that I found it impracticable to arrange the preparation in any other way. Moreover, I have no doubt that similar results may at all times be commanded by a little care and patience on the part of the dissector, and by attention to those circumstances which rendered my first dissections unsatisfactory.

We cannot, I presume, now hesitate in affirming, that the anatomy of the seal and of the porpoise do not furnish any argument against the long established doctrine of the transmission of the chyle, the nutrient fluid of the body, to the general mass of blood, by a peculiar system of vessels, consisting of one set of vessels which convey the chyle to the mesenteric glands; and of another set of a precisely similar structure, only somewhat larger, conveying the chyle more or less altered from the glands to the

thoracic duct, and thence into the veins; and it seems proved that there is no other route by which the chyle passes into the blood, or at least that no necessity arising out of peculiarity in structure has yet been shown in any animal, for its adopting a different course. The facility with which the metal reached the *vasa efferentia*, makes it probable that a structure similar to what exists in the whale, as described by Mr Abernethy, will also be found in the porpoise; that is, that certain lacteals pass directly through the glands, maintaining a comparatively large calibre throughout; but I mention this merely as a conjecture. It will afford me much pleasure, should the result of this inquiry meet with your approbation.

Edinburgh, May 1824.